MASS GIS NEWSLETTER

Massachusetts Geographic Information System

No. 3 Spring 1988

EOEA COMMITS TO DIGITAL DATA

Statewide Open Space & Land Use Funded

he Massachusetts Executive Office of nvironmental Affairs is funding the ompletion of two data layers of great mportance to a multipurpose statewide IS. The completion of both layers llustrates the usefulness of multi-agency ooperative data development in the GIS nvironment.

Protected Open Space

OEA and its departments (DEM, DFWELE, EQE, DFA, MDC) are planning to use GIS as tool to assist acquisition and anagement of open spaces. In order to anage these lands effectively, EOEA elieves a comprehensive open space nventory is required that includes state, ederal, municipal and private nonprofit ands. The creation of this inventory ill be accomplished in two phases.

uring phase 1, EOEA agencies are ompiling their open space parcels onto GS 7.5' quads for automation and ntegration into the MassGIS system. With unding from EOEA and DFWELE, the anuscripts will be digitized at the niversity of Massachusetts. Federal unds and some private holdings are also ncluded in this phase of the project, hich will be completed within a year.

he second, more difficult phase of this roject will be to automate the many roperties held by communities and private roups. Many of these data are nadequately mapped and must be researched nd brought together on a common set of ase maps. The cooperation of other gencies and the cities and towns will be ssential.

)EA's commitment to finish this data ayer follows a successful pilot project hich automated approximately 900 parcels state, federal, municipal and private pen space in Essex County, as compiled by he Essex County Greenbelt Association (see figure # 1, on page 3). At press, igitization had begun for Berkshire ounty and compilation was being completed or Hampden, Hampshire and Franklin ounties.

Land Use

EOEA has contracted The Environmental Institute and the Resource Mapping Project (RMP) at the University of Massachusetts to photointerpret and digitize land use for 178 communities in Massachusetts.

This contract follows several regional planning agency contracts with the U.Mass RMP to produce digital land use data for 173 communities. All of these efforts will result in consistent 1:25,000 quad scale digital land use maps for Massachusetts for two time periods (1971 and 1984-85). The statewide data layer should be 'on line' within 18 months.

These data are comprised of 21 categories of land use including 4 residential types, commercial, industrial, forest, 3 crop types, 3 wetland types, open land, and 3 recreation types. This data layer will support a variety of applications, including planning, historical change analysis, regional characterization, development tracking, and general inventories of natural resources (e.g. wetlands, forest).

This data layer was developed under opportunistic circumstances. It utilizes, at no-cost, a set of 1:25,000 color infrared aerial photographs that had been produced for another purpose. It takes advantage an experienced photo-interpretation lab at UMass which was ready to automate its cartographic functions; and importantly, this project was achieved via the funding of two cooperating agencies working for separate goals (MAPC/MDPW which started the project, and EOEA which will complete the state).

This cooperation should be fostered in the future and interpretations for 1990 and beyond should be planned in advance so as to ensure timely completion.

Cooperative project of the Massachusetts Hazardous Waste Facility Site Safety Council and the U.S. Geological Survey, Water Resources Division.

PARCEL MAPPING: An Improved Base Map

Many organizations collect and store data on town assessors maps. These maps are extremely detailed and generally contain the outlines of all land parcels in a given community. There is a good deal of interest in using maps which display parcels in the GIS environment in Massachusetts.

Initial explorations of adding a statewide 'parcel data layer' to the MassGIS database have highlighted both the tremendous usefulness of these data as well as some inherent problems in the source materials.

Utility

Parcel maps are the legal description of property ownership. The entire state was divided into parcels as property was occupied and then subdivided over time. Parcel maps are compiled by communities onto "assessor's maps" which display all parcels in a town. Assessor's maps are most often used by towns for tax and ownership tracking purposes.

A parcel map database in the state GIS would be useful for several reasons. First, much environmental regulation, such as land and development restrictions, are based on the parcel. In order to effectively track and enforce these restrictions, the regulating agency should have access to parcel-based records.

Second, parcel-based maps can be converted into excellent, highly detailed, land use maps (see illustration). If all parcels in the system had a 'Use Attribute' it would be possible to track development at the level at which it is occurring.

Third, a parcel data layer would greatly add to the usefulness of other data in the GIS. An example is the use of parcel data in a prioritization approach for public open space acquisition: After aquifer recharge potential, land use, wetlands, and other data were combined to isolate 'promising areas' (with potential for recreation and resource protection) parcels could be examined to see if the 'promising areas' were made up of one large parcel or many small parcels (additional information such as property owner and use would also be available as attributes). That information would support an agency's ability assess their chances of acquiring the land.

Problems

Because assessor's maps have been compiled separately by each community almost every map is prepared in a different way. Often maps are created with neither a coordinate reference system nor a standard projection and consequently getting two town maps to fit together at their border, even if reproduced at the same scale is impossible. The fact is, many parcel maps are <u>not</u> in a suitable form to be digitized and combined into a statewide data layer.

This problem was graphically demonstrated by the CCAMP-GIS project. Portions of the parcel maps for the adjacent towns of Barnstable and Yarmouth were digitized. Despite ARC/INFO's powerful capabilities to transform coordinates and projections the two maps could not be combined to produce a seamless, cartographically accurate map. While these maps were used effectively to assess growth and public water supply issues in those towns, the lack of coordinate reference and standard projection in the parcel maps made it difficult reliably overlay other environmental data, such as quadrangle information, that was generated in standard projections.

Another problem with developing a parcel data layer is high cost. Initial digitizing costs are high because parcel maps are very detailed. Digitizing costs translate to money per polygon and in a typical town there are thousands of parcels. By comparison there are only a few hundred land use polygons in each town. Developing digital parcel maps now, would require an investment which would be paid off, through lower maintenance, over time.

Finally, an important data issue that must be addressed in the development of digital parcel maps is map maintenance. Property constantly changes ownership and parcels are subdivided. If these digital data are to be assembled a program of updating and maintaining the map database must be implemented and strongly supported.

Prospectus

Clearly assessor's maps should remain the responsibility of the municipality. In fact, many communities are investigating GIS technology as a means of automating their assessing functions. The City of

Boston uses an Intergraph-based GIS to manage their land records. Other smaller towns, like Dartmouth, have begun using PC based products, such as PC ARC/INFO. The move to automated technology is spurred in large part by the aforementioned updating/maintenance issue. Digital maps are easier, and in the long term, more cost-effective to update. Additionally, communities can use the automated parcel maps and other digital data for their own planning and monitoring purposes.

The challenge for the state, which has an interest in statewide data, is to have the parcel mapping done in standard projections and coordinate schemes that allow adjacent towns to be accurately matched, and integrated into a statewide data layer. EOEA maintains, and can make available guidelines which describe these standards.

It will be a major, long term undertaking to complete a parcel data layer for all 351 communities in Massachusetts. Currently, however, many consulting firms can deliver new assessor's maps in suitable digital format. State and regional planning groups should encourage digital mapping and support it when appropriate. Over time, a system can evolve where the state receives regular updates of parcel information from communities. In turn the state can provide up-to-date environmental data to the communities. In the short term communities should, <u>at least</u>, attempt to insure that new parcel mapping be done digitally or in a format which allows easy digitizing and compatibility with neighboring maps.

Figure 1

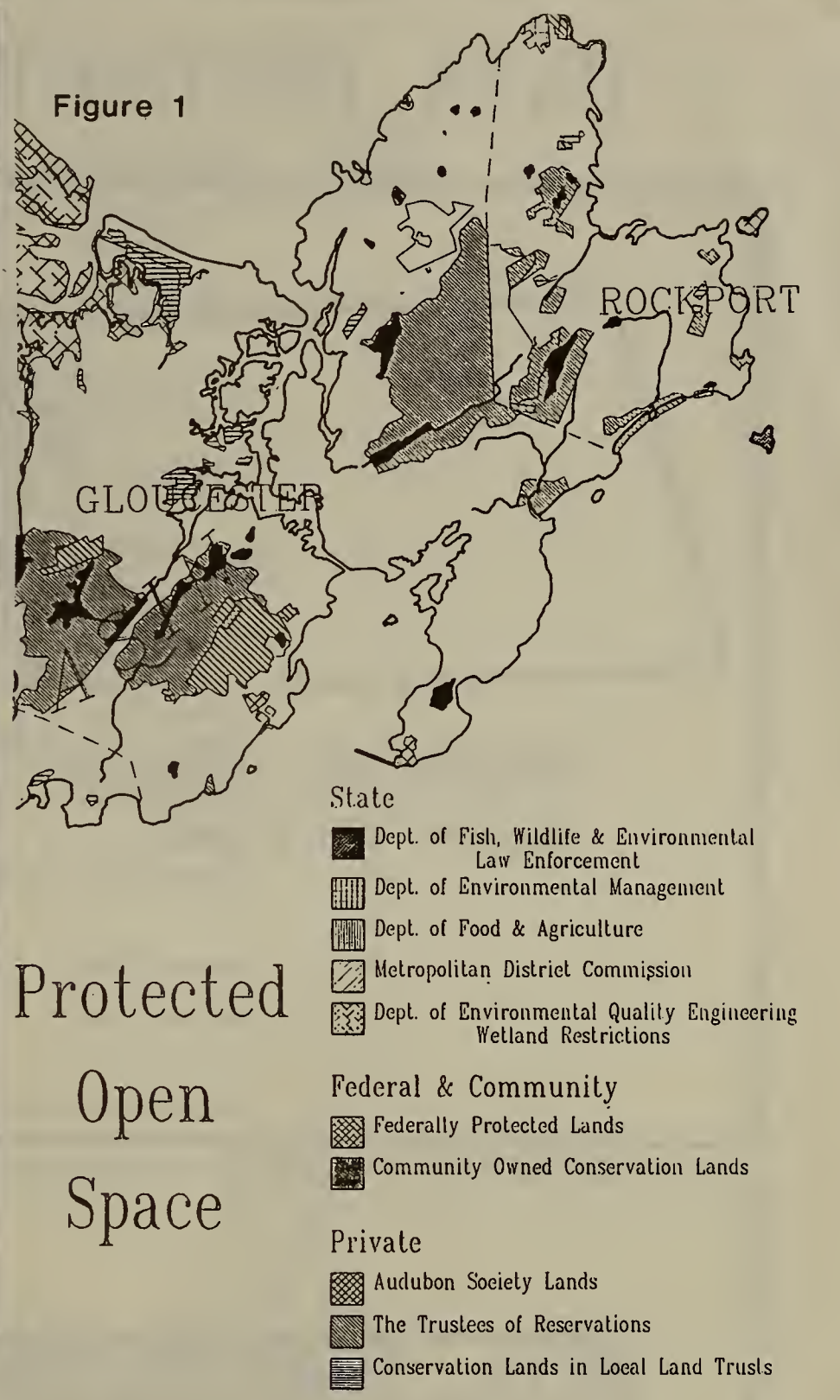
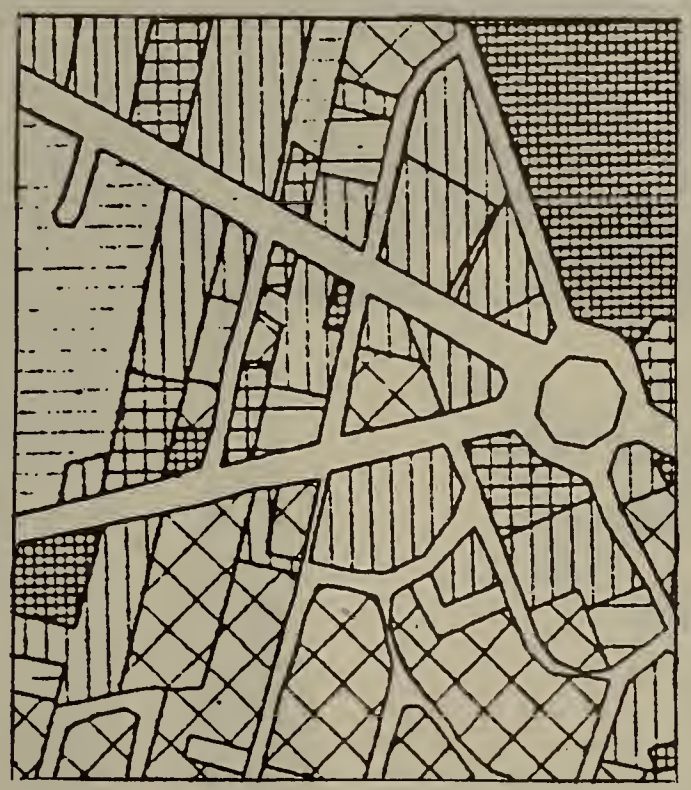


Figure 2

'arcel map with ID-code



Map shaded by 'Use' attribute code

Entertainment

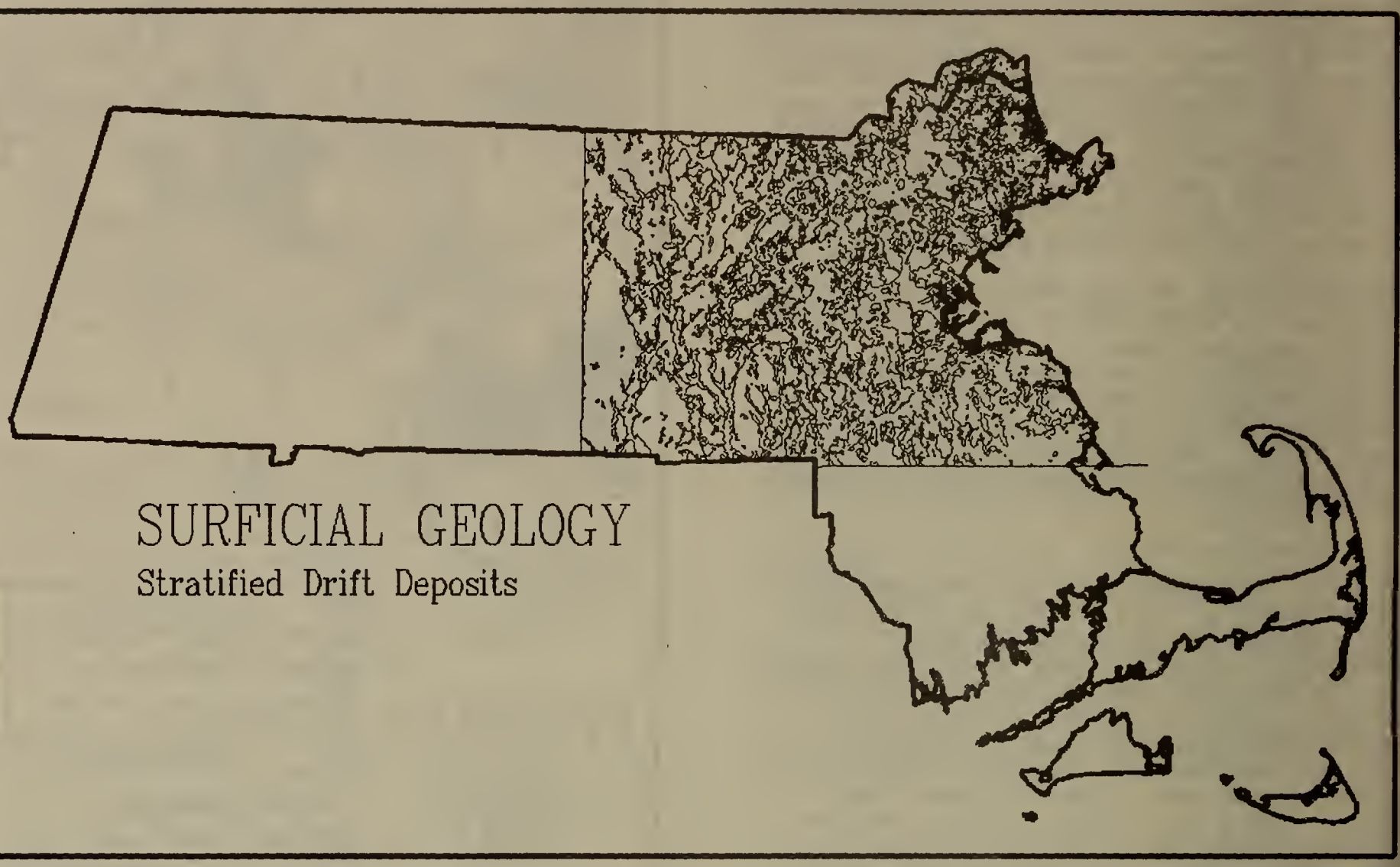
Residential, Single and Multifamily

Hotels, Motels, Inns, and Restaurants

Offices and Public Services

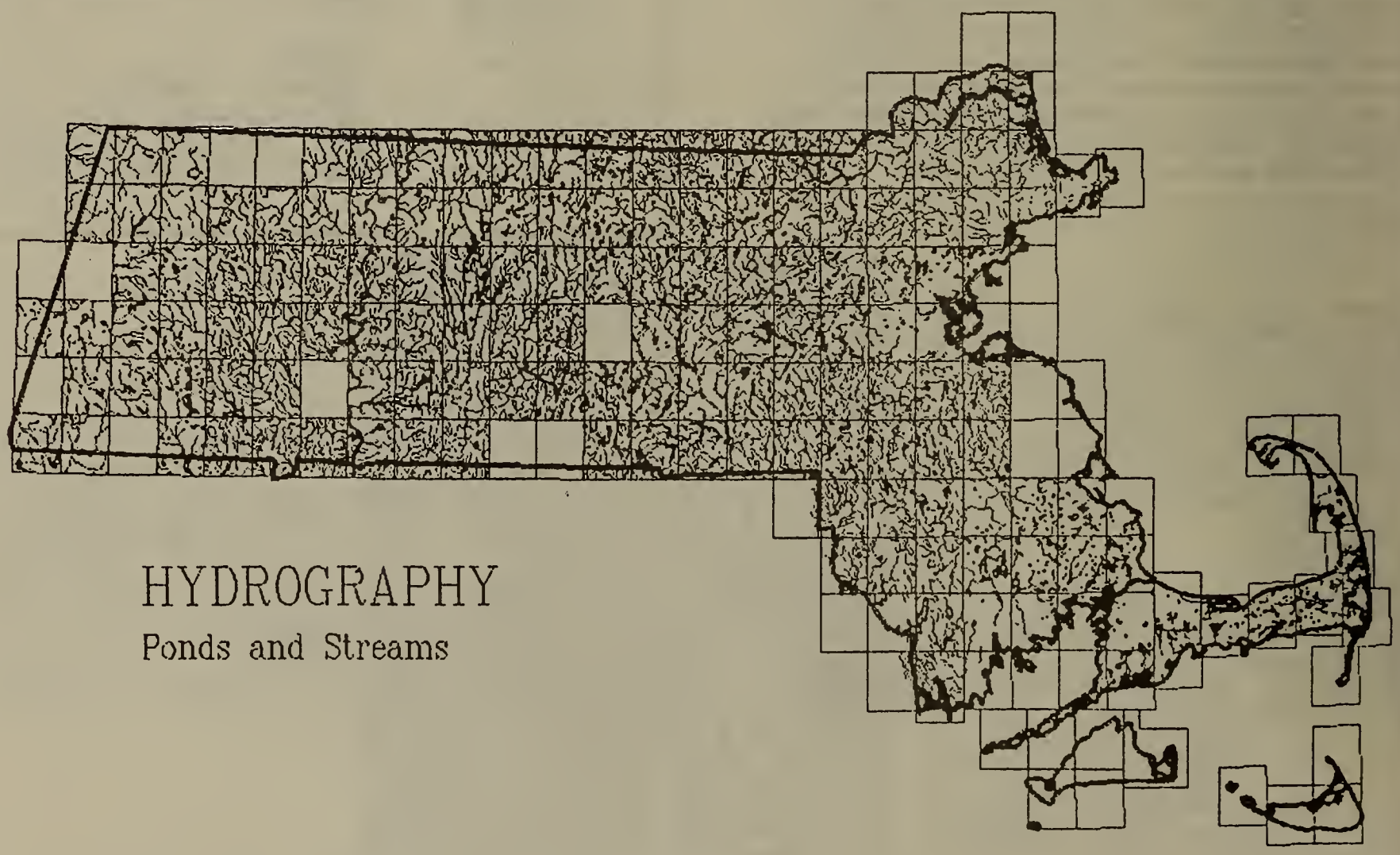
Retail

DATA PRODUCTION STATUS



SURFICIAL GEOLOGY

Stratified Drift Deposits



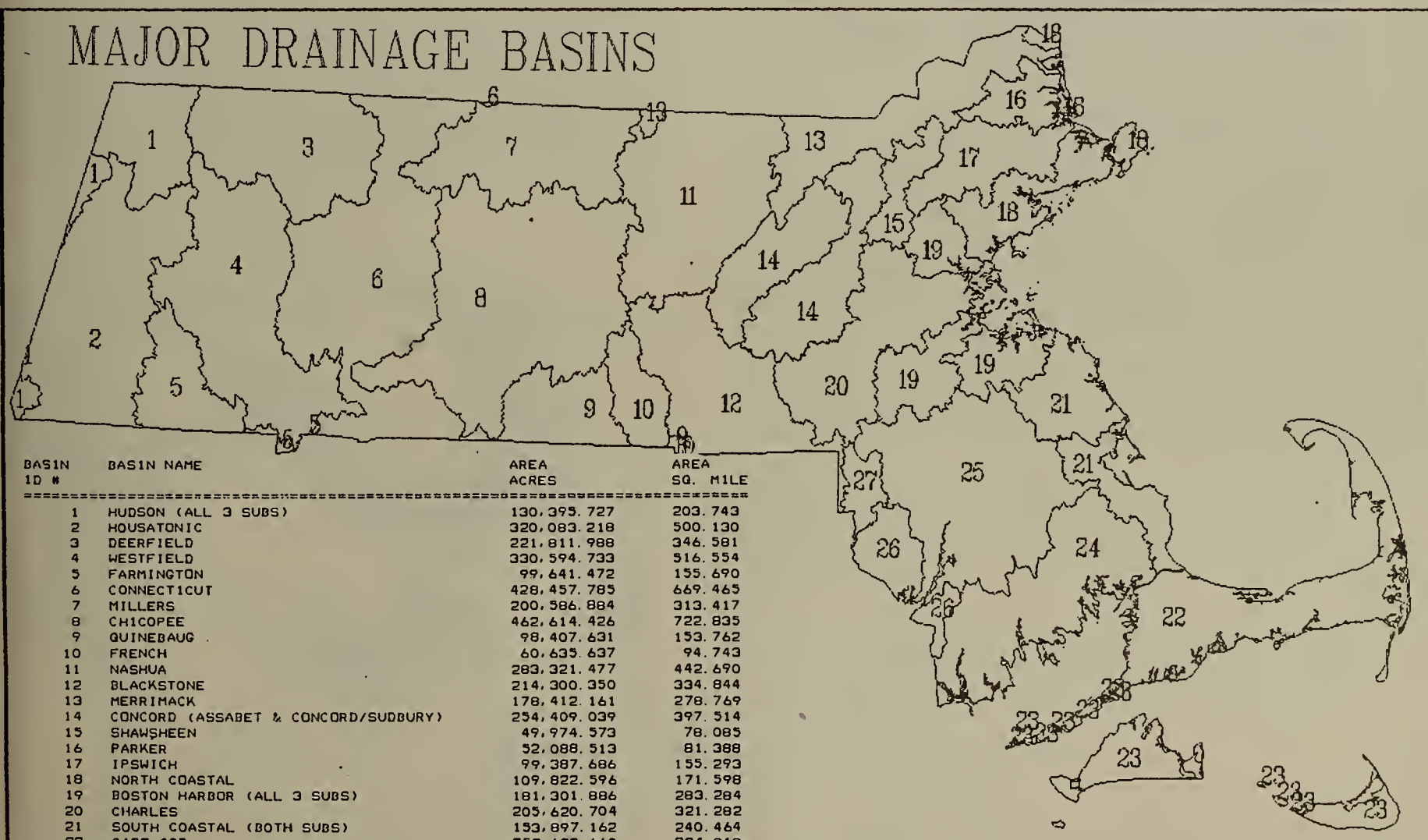
HYDROGRAPHY

Ponds and Streams

STATUS OF MASSGIS DATA LAYERS

DATA LAYER	SCALE	SOURCE	AUTOMATION	%COM-PLETE
POLITICAL BOUNDARIES	1:25,000	USGS 7.5 minute mylar quads	Digitized by MassGIS	100
DRAINAGE BASINS	1:25,000	USGS 7.5' paper manuscripts	Digitized by MassGIS	100
SURFICIAL GEOLOGY	1:125,000	USGS-GD unpub-lished manuscpt	Digitized by MassGIS	50
HYDROGRAPHY (streams,ponds)	1:100,000	USGS-NMD DLG data	Reformat, code attributes	80
ROAD NETWORK	1:100,000	USGS-NMD DLG data	Reformat, code attributes	20
LANDUSE	1:25,000	UMass DFWM	Digitized by Umass	20
ELEVATION	1:25,000	NMD Digital El-evation Models	Reformatted	1
ELEVATION	1:250,000	Defense Mapping Agency	Reformatted	30
CENSUS TRACTS	1:250,000	USGS-NMD GIRAS data	Reformatted	50
WASTE SITES	--	Mass DEQE	Reformatted	100
PUBLIC SUPPLY WELLS	--	USGS SWUDS database	Reformatted	100
GEOGRAPHIC NAMES	1:25,000	USGS Natl Carto Info Center	Reformatted	100

MAJOR DRAINAGE BASINS



BASIN ID #	BASIN NAME	AREA ACRES	AREA SQ. MILE
1	HUDSON (ALL 3 SUBS)	130,395,727	203.743
2	HOUSATONIC	320,083,218	500.130
3	DEERFIELD	221,811,988	346.581
4	WESTFIELD	330,594,733	516.554
5	FARMINGTON	99,641,472	155.690
6	CONNECTICUT	428,457,785	669.465
7	MILLERS	200,386,884	313.417
8	CHICOPEE	462,614,426	722.835
9	QUINEBAUG	98,407,631	153.762
10	FRENCH	60,635,637	94.743
11	NASHUA	283,321,477	442.690
12	BLACKSTONE	214,300,350	334.844
13	MERRIMACK	178,412,161	278.769
14	CONCORD (ASSABET & CONCORD/SUDBURY)	254,409,039	397.514
15	SHAWSHEEN	49,974,573	78.085
16	PARKER	52,088,513	81.388
17	IPSWICH	99,387,686	155.293
18	NORTH COASTAL	109,822,596	171.598
19	BOSTON HARBOR (ALL 3 SUBS)	181,301,886	283.284
20	CHARLES	205,620,704	321.282
21	SOUTH COASTAL (BOTH SUBS)	153,897,162	240.464
22	CAPE COD	252,683,660	394.818
23	ISLANDS	101,088,390	157.951
24	BUZZARDS BAY	239,415,949	374.087
25	TAUNTON	339,049,315	529.765
26	NARRAGANSETT BAY & MT. HOPE BAY SHORE	71,585,140	111.852
27	TEN MILE	31,109,172	48.608

Area as measured by the ARC/INFO system.
Measurements include major islands.

GLOSSARY

ATTRIBUTE: Database information stored about graphic features. Points, lines and polygons all have attributes. e.g. Some basic attributes of public water supply well points include: 1) well name, 2) water company name, 3) gallons/day provided, 4) towns served, 5) any other information compiled. Attributes of lines include length, attributes of polygons include area and perimeter.

COVERAGE: Is the ARC/INFO name for a unit of digital data. The coverage is tantamount to what a word processing package calls a file. Each coverage is made up of several files which control the graphics, the coordinates, and the attributes of the data. Each data layer may be made up of several coverages.

DLG (Digital Line Graph): Is a standard format for spatial data created and promulgated by the USGS- National Mapping Division. MassGIS Project is buying the hydrography and transportation data layers from USGS in DLG format.

DATA LAYER: Is a group of digital data regarding one particular theme. In the MassGIS database a data layer means a group of 'coverages' that make up the entire state for one theme. For example, 189 quadrangle coverages of transportation data make up the statewide transportation data layer. MassGIS project is developing 8 statewide data layers (see database update).

FEATURES: Refer to the geometry of what is encoded in the digital data. The MassGIS database is comprised of POINT, LINE and POLYGON features. Points might be the location of a well, lines might be a road or stream, and polygons might be the boundary of a state forest or the perimeter of a pond.

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GIS (Geographic Information System): Is an automated system designed to accept large volumes of spatial data, derived from a variety of sources, and to efficiently store, retrieve, manipulate, analyze and display these data according to user-defined specifications (after Marble & Peuquet 1984).

MASS. STATE PLANE COORDINATE SYSTEM (SPC): Is a rectangular coordinate system derived by the National Ocean Survey and Mass. DPW. It was developed to provide surveyors and engineers accurate ground control. The units of SPC are feet, and the origin of the state plane grid is in New York State. SPC reference points are printed on USGS quadrangles.

POLYGONS: Are a group of lines, making up any shape, that enclose an area. A polygon can be represented by a single line with the same beginning and end point.

QUADRANGLES (QUADS): Are the USGS-National Mapping Division standard, medium scale, topographic base map. In Massachusetts, quads are 1:25,000 scale maps that cover an area of 7.5' X 7.5' (12.6 X 8.5 miles) or 7.5' x 15' (12.6 X 17 miles).

TICS: Are map locations for which the coordinate value is accurately known. In the GIS tics are used to register a printed map to the digital database before digitization. The MassGIS project uses the quadrangle corners (which have the latitude and longitude printed on them) as tics for manuscripts compiled on USGS quads.

MASS GIS NEWSLETTER

Massachusetts Geographic Information System | Number 4 Fall 1988

U.S. Geological Survey Leads In Developing New Digital Data

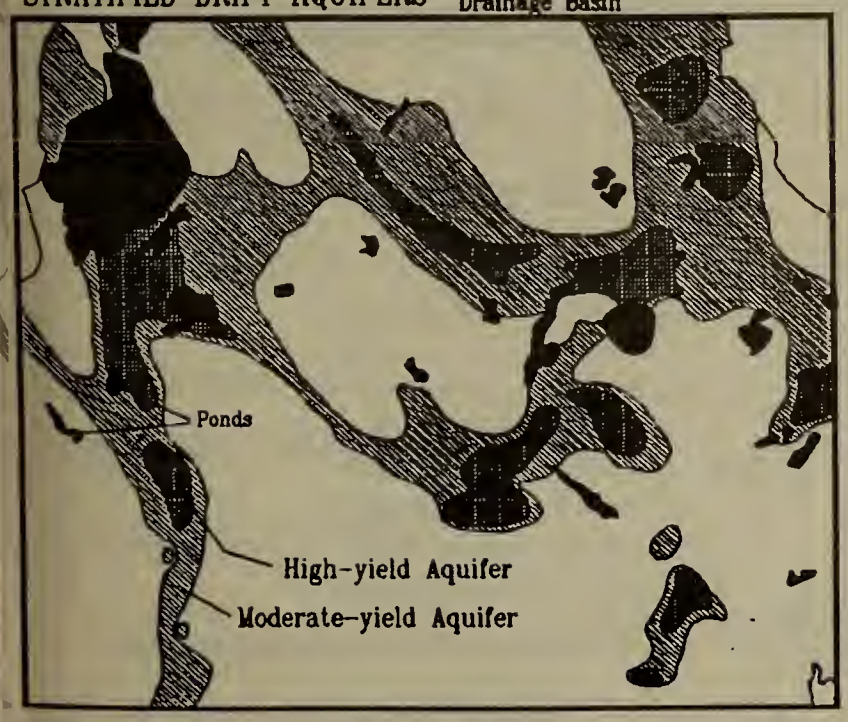
The U.S. Geological Survey, Water Resources Division, Boston, Mass., conducts approximately 20 water-resources projects per year in Massachusetts in cooperation with Federal, State, and local government agencies. Two of the largest and oldest USGS cooperative programs are with MDEQE-DWPC (Massachusetts Department of Environmental Quality Engineering-Division of Water Pollution Control), and MDEM-DWR (Massachusetts Department of Environmental Management-Division of Water Resources). Since the installation of ARC/INFO GIS software on the Survey's Prime computer in 1986, a growing number of projects have applied GIS technology to project work and are developing GIS databases.

AQUIFERS

The Survey is digitizing the outlines of the sand and gravel aquifers in the state that yield water for public water-supply wells. This work culminates and helps summarize a USGS-MDWR 20-year hydrologic reconnaissance effort to map the water resources of the states' 27 major planning basins.

Continued on page 8 - USGS

STRATIFIED DRIFT AQUIFERS Detail of Buzzards Bay Drainage Basin



MWRA Supports Pilot Watershed Project

During the summer, the MassGIS project successfully completed a pilot watershed management/protection study on behalf of the MWRA (Massachusetts Water Resources Authority).

Project Goals

The one-month study was undertaken to provide MWRA with land statistics aggregated by town and with useful map products. The MassGIS project was interested in the opportunity to gather additional hydrologic data in the pilot watersheds and develop automated methods for updating existing 1:100,000 DLG hydrography data and analyzing the information. MassGIS staff completed the technical work in consultation with MWRA and delivered three sets of 9 color wall maps and accompanying statistics (see figure, page 7).

MWRA requested the pilot study to demonstrate the capability of GIS technology to generate buffer areas of fixed size around ponds and tributary streams in the Ware River, Wachusett, and Quabbin watersheds and to quantify the amount of area encompassed by the buffers. The MassGIS project team viewed the pilot study as an important test of the accuracy and completeness of the 1:100,000 DLG data with a goal of determining what percentage of streams and ponds, if any, existed on 1:25,000 quadrangle maps but *not* in the 1:100,000 DLG data. The project benefited from the participation of the MDC (Metropolitan District Commission), Watershed Division and the Massachusetts Audubon Society. MWRA provided funding support to the project by joining in a cooperative agreement with the USGS directly related to the USGS/HWFSSC cooperative project.

The Step-By-Step Approach

The project was completed in a series of steps that are typical of the types of tasks involved in completing an analytical GIS project.

1. Project staff reviewed available digital data (basemap and hydrography) from the MassGIS database and identified data gaps.

Continued on page 7 - MWRA

Cooperative project of the Massachusetts Hazardous Waste Facility Site Safety Council and the U.S. Geological Survey, Water Resources Division

Organizing Data

The Design of the MassGIS Database

The MassGIS database is designed to meet the needs of a continually expanding database and diverse user community. While flexible, the database is strictly organized to facilitate user access to large amounts of data and to keep track of data updates and revisions, off-line data storage, and data documentation. This article describes the way in which the MassGIS database was designed.

A GIS database must be designed to make efficient use of limited computer resources. Computer storage is of special concern with the typically large volume of data contained in a GIS. The MassGIS project operates within a fixed quota of about 400 megabytes of storage on the USGS Prime computer. Although this quota is permitted to grow with the database, it constantly enforces the need to maintain a stream-lined and well-organized database.

Hierarchical Organization
MassGIS data are organized in a typical hierarchical directory structure (see figure). The top level of the hierarchy breaks the database into functional categories. The category 'Completed Data Layers' represents only a fraction of the information which makes up the entire database. Each of the other categories represents an important database function such as developing new data, cataloging off-line data or storing often-used graphics.

The second tier in the hierarchy organizes the data by layer (a data layer is a theme such as Landuse, Streams, Roads). The third tier organizes each data layer by geographic area (by town, quad, etc.).

MassGIS also uses file-naming conventions that help identify the numerous types of files typically generated in a GIS system such as coverages, macros, and output map compositions. Naming conventions also identify geographic areas. For example, 'Streams-midw' represents streams in midwestern Mass. and 'R135' represents roads in quad number 135.

Production vs Final Data
MassGIS distinguishes between data layers that are under development and those that are completed and verified. The largest part of the database is data under development in the 'Production Data' directory. The computer storage space required to assemble these data is much larger than the space required to store the final data layer. For instance, the completed Town Boundaries data layer consumes only 1 megabyte but the space required during its production exceeded 25 megabytes. Once completed, verified, documented, and archived, a data layer is moved to the 'Data' directory of the database where it is made available to users and where it resides until revised.

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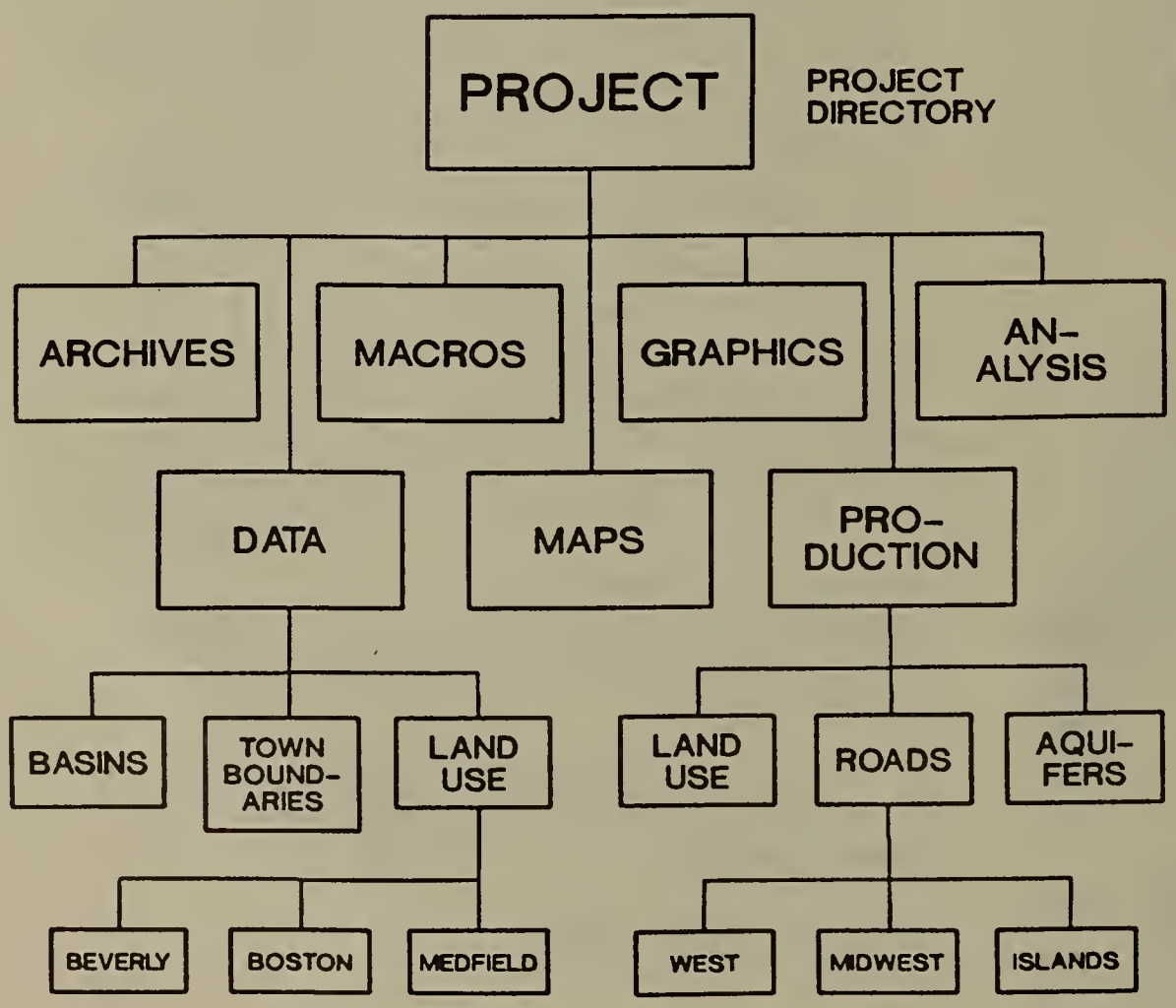


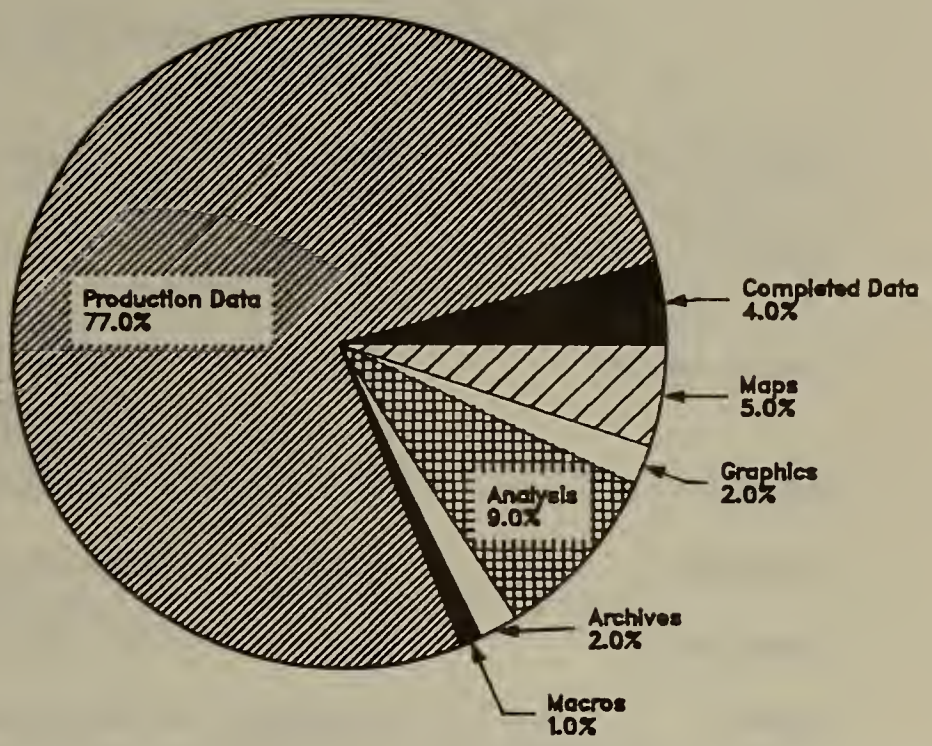
MassGIS Hierarchal Database Organization - October 1988

Data Paneling
For ease and speed of data access, MassGIS stores each data layer in several geographic sections or panels. The size of the panel depends on the density of features within the data layer and on the most common unit by which users will want to access it.

A low density layer such as Town Boundaries is stored in one state-wide panel. A very dense layer such as Roads is stored in 189 quad-sized panels which are more quickly accessed than an unwieldy state-wide panel. Another very dense layer, Landuse, is stored by town rather than by quad because that is the anticipated unit of user access. The Streams and Ponds layers which are purchased as 189 individual panels, are assembled into 7 larger panels of 20 or 30 quads each, such as 'Midwest'.

Data Storage
MassGIS stores 3 to 4 times the amount of on-line data off-line on magnetic tapes. The off-line storage includes snapshots of data layers in successive stages of development. These snapshots are crucial as backups in case of accidental loss of on-line information, and as an audit trail in case data-processing errors are discovered.

Off-line storage is also considered an extension of the on-line database when storage space limitations force the project to juggle pieces of the database back and forth between disk and tape. This juggling can only be accomplished if the database is efficiently organized in sections of a manageable size.



Proportion of Storage Space in First-Level Directories

Off-line storage is also an important archival record of the Analysis and Maps directories. The contents of these directories are not permanent parts of the database, but are derivative products generated from it. When they are complete they can be moved off-line, freeing valuable storage space.

The organizational scheme of the MassGIS database can serve as a model for other GIS databases, whether local or regional. The MassGIS design facilitates user access by allowing users to see at first glance what data and programs are available. The design also facilitates database management tasks such as data archiving and updating.

First-Level Directories of the MassGIS Database:

MACROS Custom-written programs for data processing.

ARCHIVES Catalogs of data stored off-line.

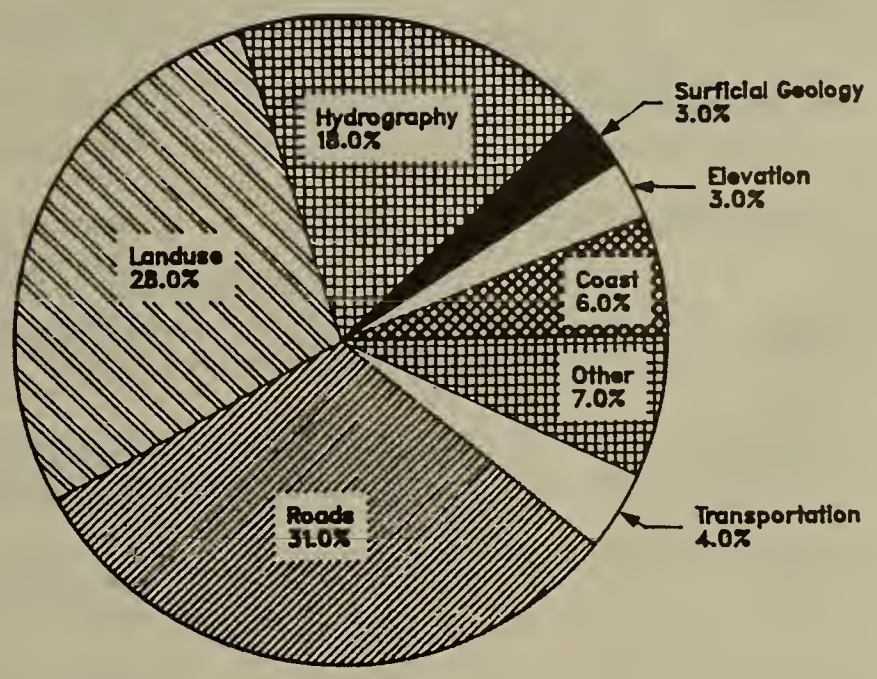
DATA Completed data layers.

PRODUCTION Data layers in the development and assembly stage.

ANALYSIS Workspace for applications project work.

MAPS Storage area for all map compositions and plot files.

GRAPHICS Map-making accessories (scale bar, north arrow, logos, etc.).

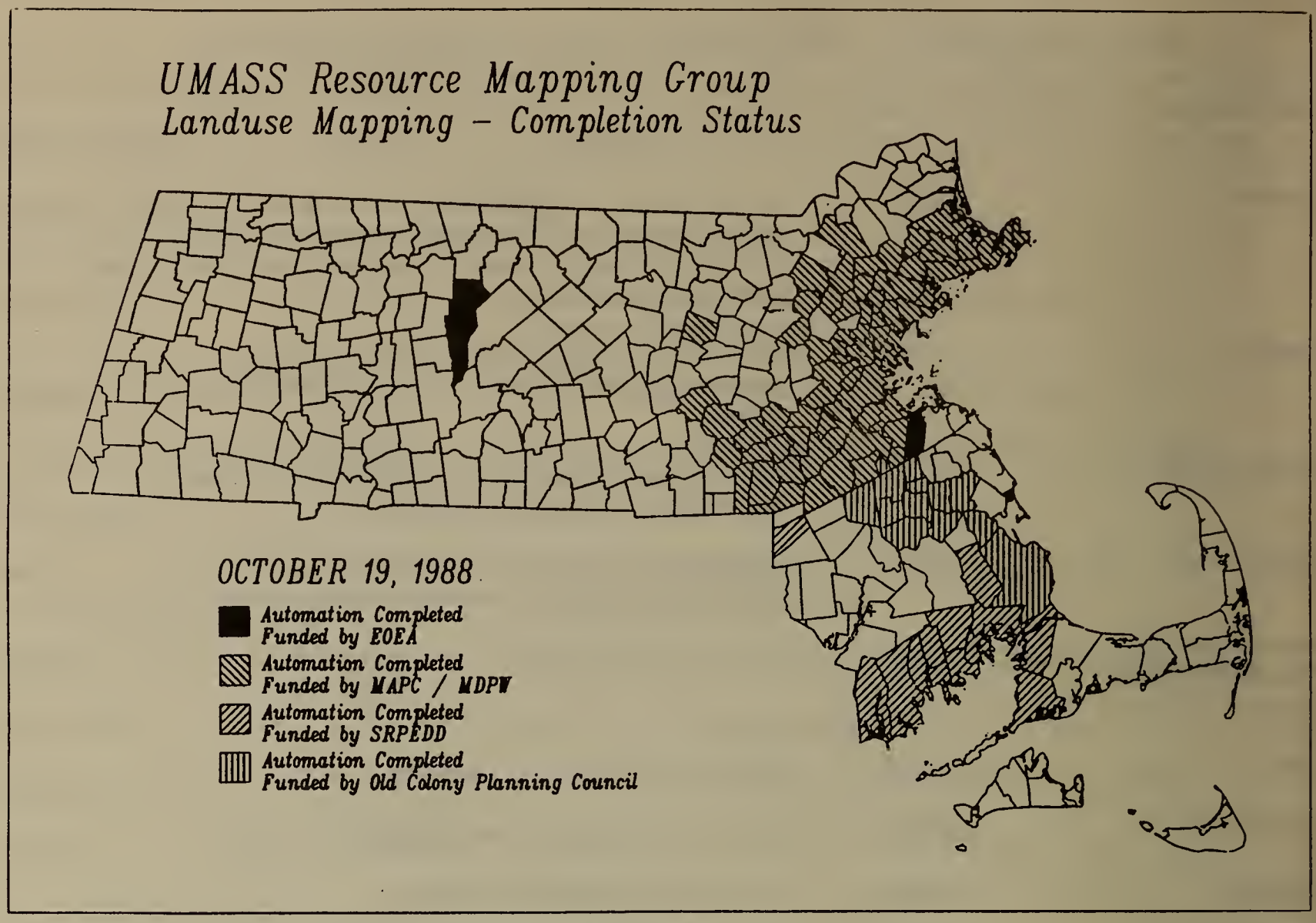


Proportion of Storage Space in Production Data Directory

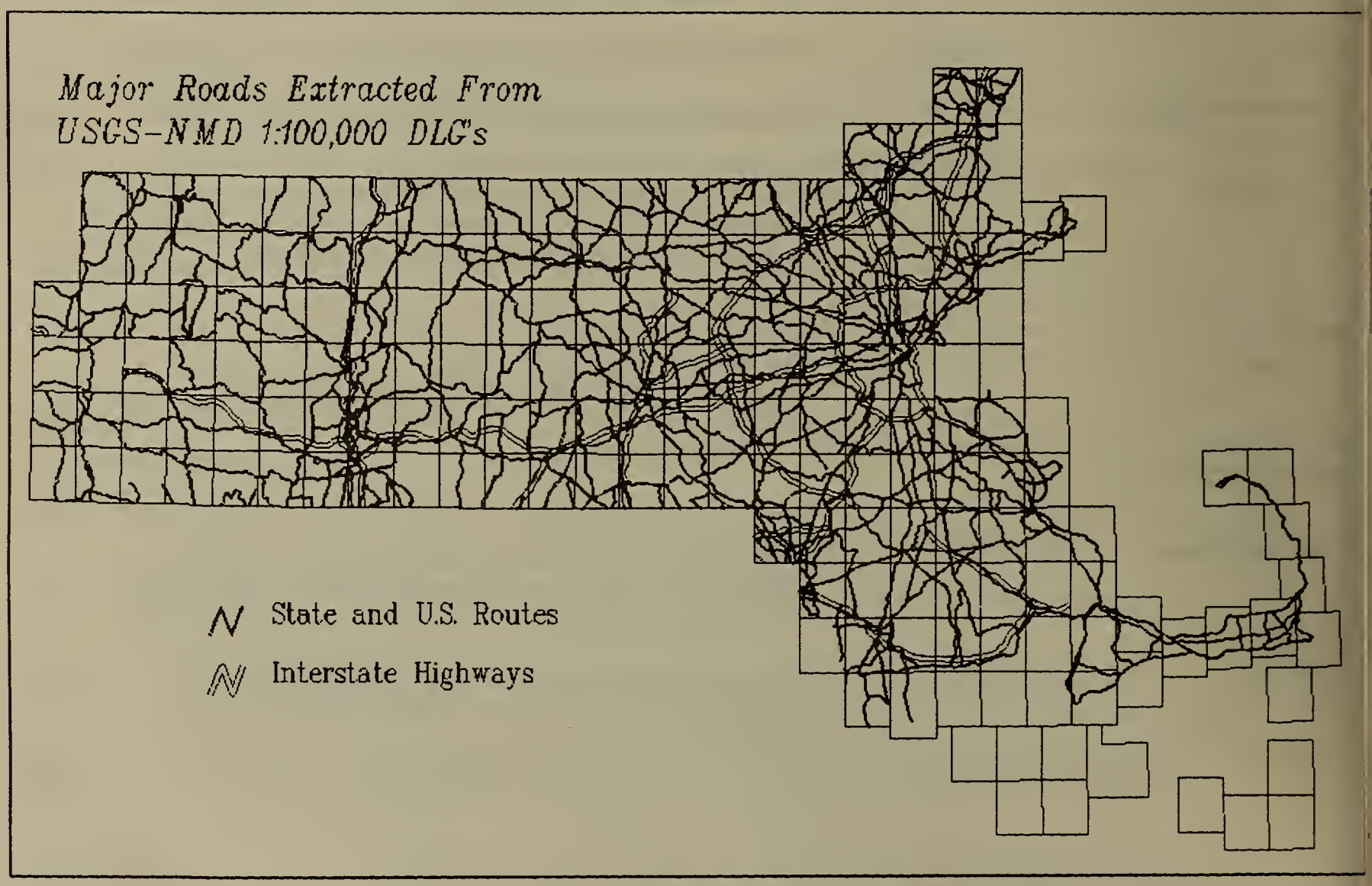
Status of MassGIS Database - October 1988

DATA LAYER	SCALE	DESCRIPTION
POLITICAL UNITS		
Town boundaries	1:25,000	Town boundaries digitized by MassGIS from 189 mylar USGS topographic quadrangle maps.
Counties	1:25,000	Counties extracted from the Town Boundary data layer.
Quadrangles	1:25,000	Outlines of 189 USGS 7.5-minute quadrangles for Massachusetts.
Senate districts	1:25,000	State senatorial districts.
Coastline	1:100,000	Coastline extracted from USGS National Mapping Division (NMD) 1:100,000 DLG database.
Coastline	1:5,000	CZM (Coastal Zone Management) historical data on shoreline change.
Census tracts	1:250,000	Census tracts from the USGS-NMD GIRAS database.
Population	1:2,000,000	Centroids of census blocks: population statistics for 1970, 1980.
ZIP Codes	1:2,000,000	U.S. Postal ZIP code zones from the USGS-WRD files.
HYDROLOGIC FEATURES		
Streams	1:100,000	Streams from USGS-NMD 1:100,000 DLG database.
Ponds	1:100,000	Ponds and lakes from USGS-NMD 1:100,000 DLG database.
Bogs	1:100,000	Commercial cranberry bogs from USGS-NMD 1:100,000 DLG database.
Aqueducts/Canals	1:100,000	Waterways from USGS-NMD 1:100,000 DLG database.
Wetlands	1:25,000	Extracted from Landuse data layer. Mostly non-forested wetland areas. 100 of 351 towns are complete.
Sub-Drainage Basins	1:25,000	Outlines of major surface-water drainage divides differentiating MDWR 27 Planning Basins.
Minor Drainage Basins	1:25,000	Outlines of sub-basin drainage areas as defined by USGS-WRD. Digitized from USGS 7.5 minute quadrangles.
GWSI	1:25,000	Well locations from the USGS GWSI (Ground-Water Site Inventory) database.
SWUDS	1:25,000	Public-water-supply sites (both surface and groundwater) from USGS-WRD SWUDS (State Water-Use Database System.
Dams	1:2,000,000	Dams (with numerous attributes from EPRI (Environmental Power Resource Institute)/USGS-WRD.
Aquifers	1:48,000	Sand and gravel deposits that yield water sufficient for public supply. From USGS/MDWR State Hydrologic Atlas maps.

TOPOGRAPHIC/GEOLOGIC FEATURES		
Elevation	1:25,000	Land-surface elevation data, 30 m. intervals, accuracy greater/equals 15 m. Partial state coverage from USGS-NMD DEM (Digital Elevation Model) database. 10 of 189 state quadrangles available.
Elevation	1:250,000	Land-surface elevation data, 90 m. intervals, accuracy greater/equals 200 m. State-wide coverage from the Defense Mapping Agency.
Bedrock geology	1:250,000	Composite bedrock types adapted from 'Bedrock Geology of Massachusetts' map. 50% complete.
Stratified drift	1:125,000	Undifferentiated areas of stratified drift deposits. From USGS-Geologic Division unpublished mylar manuscripts. 75% complete.
TRANSPORTATION		
Roads	1:100,000	USGS-NMD 1:100,000 DLG database.
Major Roads	1:100,000	Interstate, U.S., and state routes extracted from Roads.
Railroads	1:100,000	USGS-NMD 1:100,000 DLG database.
Transmission Lines	1:100,000	Power and pipelines from USGS-NMD 1:100,000 DLG database.
Airports	1:25,000	Point locations of 200 airports from Mass. Aeronautics Commission.
Transportation Zones	1:25,000	Transportation planning zones for 74 Boston metropolitan towns.
OPEN SPACE	1:25,000	Federal, state, and private non-profit conservation lands. Compiled by EOEA on 7 1/2-minute quadrangle maps and digitized by UMass. Completion is scheduled for January 1989.
LANDUSE	1:25,000	21-category landuse interpreted from color-infrared photographs by UMass Resource Mapping Group. 1971 and 1985 data available: 100 of 351 towns completed.
MISCELLANEOUS		
Geographic Names	1:25,000	Names/locations of all geographic features named on USGS 7.5-minute quadrangle maps. From USGS National Cartographic Center, GNIS (Geographic Names Information System) database.
Waste sites	1:25,000	1200 DEQE-identified waste sites, including landfills, NPDES sites, hazardous waste sites, salt storage piles, and incinerators. Not verified.



Status of Landuse Mapping - October 1988



Status of Major Roads Mapping - October 1988

MWRA - *continued from page 1*

2. 1:100,000 DLG hydrography data were checked against 1:25,000 quadrangle maps to locate missing ponds and streams. The 1:100,000 hydrography data were then used as templates, and a digitizer was used to add the missing arcs and polygons. The project determined that approximately **5-10 percent** of the ponds and 20-30 percent of the streams were missing from the 1:100,000 DLG data.

3. Concurrently, a pilot-project database was assembled for the towns of Sterling, West Boylston, Hubbardston, New Salem, and Petersham by copying the following pieces of data from the MassGIS database:

Streams
Ponds
Drainage basins
Roads
Political Boundaries
Waste Sites
Public Water Supplies
Quabbin & Wachusett Reservoir
Quadrangle Boundaries

4. The data were analyzed and all tributary streams were identified by comparing hydrography with the drainage basin boundaries. All tributaries in each town were overlain with 200- and 400-foot buffer areas. Buffer-area overlap was evaluated and calculated for each town.

5. Final summary statistics were generated with the database management system and maps were composed. The area of each town encompassed within the 200 and 400 foot buffer was calculated and compared to the size of each town. Then summary percentage statistics were prepared. The results were illustrated on a series of large poster-sized maps showing the buffer areas and land statistics for each town.

Ideas For Additional Study

This project was a first step in applying GIS technology to assist in watershed protection planning. Additional analytical steps for this project might include combining the buffer areas with landuse data to determine the amount and types of land uses within each buffer. Also, the buffer areas might be combined with protected open-space data to determine the amount of land area already set aside for preservation. Of particular interest are the possible impacts on water-quality in the streams from different types of land uses and waste sources, especially those within buffer areas.

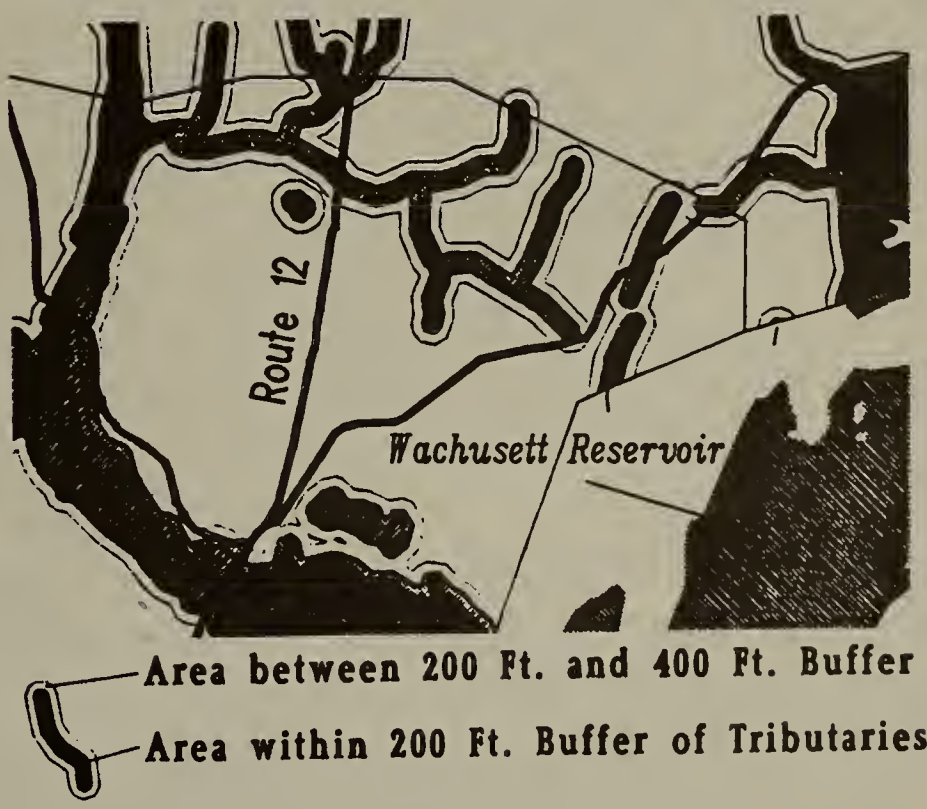
Example map showing buffer areas around streams and ponds --->

EOEA Modernizes Computer System Bringing GIS In-House

EOEA (Massachusetts Executive Office of Environmental Affairs) has selected a primary vendor for its Systems Modernization Project, a multi-million dollar procurement to modernize the computer systems of all agencies within the environmental Secretariat. The project is the result of three years of research and planning. A major goal of the new system is to provide the most accurate and up-to-date environmental data to decisionmakers.

A GIS is seen as a cornerstone of the EOEA modernization effort. The system RFP distributed by EOEA in July 1988 required that the new computer system be capable of supporting 26 GIS terminals simultaneously.

The EOEA Selection Board has recommended to BSPP (Massachusetts Bureau of Systems Policy and Planning) that McDonald Douglas, Corp. be selected as the primary vendor. Pending successful negotiation of contract terms, McDonald Douglas will provide Digital Equipment Corporation VAX computer hardware, ARC/INFO GIS software, and ORACLE database management software to EOEA. Contract specifications call for the installation of the main computer system within 3 months of contract approval, including installation of the GIS software, some hardware, and the database management system. When the GIS system becomes operational, EOEA agencies which are ready with GIS data and applications will be able to start work. Also, data from the MassGIS database will be put on the system forming the foundation of the new state GIS system.



USGS - *continued from page 1*

A summary 'atlas' report describing the results of the long-term study is nearing completion. The sand-and-gravel aquifer database is scheduled to be completed by the end of the year.

GENERALIZED BEDROCK GEOLOGY

The outlines of composite bedrock types are being digitized from the Bedrock Geology map of Massachusetts to form a generalized, statewide bedrock GIS coverage. This work supports another ongoing Survey project which is attempting to relate the quality of water in Massachusetts public-supply wells to the regional bedrock geology of the state.

ENHANCED HYDROGRAPHY

The 1:100,000 DLG Hydrography data has been modified on 32 of 189 quadrangles as part of a research project on the estimation of streamflow at un-gaged sites. The 1:100,000 hydrography database has been updated to include the approximately 5-10 percent of the ponds and 20-30 percent of the streams on the 1:25,000 Massachusetts quadrangle maps that are not included in the 1:100,000 digital data.

PUBLIC WATER SUPPLIES

Extensive effort has been devoted to updating and improving the state's public water supply database. During 1988, the Survey, in cooperation with MDWR and MDWS (MDEQE-Division of Water Supply) joined forces to both field-verify locational position and check the attribute information of these data before entering them into the Surveys' SWUDS (State Water Use Data System) database. GIS programs have been prepared to convert SWUDS data into a GIS database. In the last three years, the Survey has devoted increasing efforts to assist the state in developing a computer database that stores comprehensive information on water use.

OTHER

Beginning in October 1988, The Survey will start development of several new GIS databases as part of planned, new project work. Among these databases are the establishment of a Cape Cod regional GIS database in cooperation with CCPEDC (Cape Cod Planning and Economic Development Commission) that will build upon the existing CCAMP-GIS database developed in 1987-88. Also, a streamflow-measurement-site database converted from the Surveys' NWIS (National Water Information System) database is being developed in support of a statewide basin-yield project with MDWR.

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